
Incompletely fractured teeth associated with diffuse longstanding orofacial pain: diagnosis and treatment outcome

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Abstract

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Aim To evaluate the diagnostic value of different clinical findings, and analyse the symptoms experienced from teeth with incomplete dentinal fractures in patients with diffuse orofacial pain. Secondly, to present the outcome of different treatment modalities in these patients.

Methodology Thirty-two patients, referred to the teaching clinic at the Faculty of Dentistry, University of Bergen, with poorly localized orofacial pain, were finally diagnosed with 46 incompletely fractured teeth. The distribution and pattern of pain was thoroughly recorded for each patient. The final diagnosis, incompletely fractured tooth, was obtained after removal of fillings and direct inspection of possible fracture lines.

Results Many of the patients had suffered diffuse orofa-

cial pain for more than 1 year, and had earlier consulted dental and medical expertise. Direct inspection of fracture lines, combined with staining solution and transillumination proved to be the best diagnostic tools. The longer the duration of pain before the diagnosis of an incompletely fractured tooth was established, the more diffuse was the distribution of pain. Endodontic or restorative treatment relieved the symptoms in 90% of the patients, whilst persisting symptoms in 10% were considered part of an orofacial pain complex of obscure aetiology.

Conclusion This study shows that the diagnosis of the incompletely fractured teeth in patients with longstanding diffuse orofacial pain symptoms are time consuming and represent a diagnostic problem. With appropriate endodontic and/or restorative treatment, symptoms were relieved in the majority of cases.

Keywords: diagnostics, endodontics, orofacial pain, pulpitis.

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Introduction

Incompletely fractured teeth associated with pain, have been referred to as a diagnostic challenge (Cameron 1964). Various terms have been used to describe this type of tooth fracture, such as 'green-stick fractures' (Sutton 1962), 'split root syndrome' (Silvestri 1976) and 'cracked tooth syndrome' (Cameron 1964). The incompletely fractured tooth has been defined as 'a tooth with a demonstrable fracture, but no visible separation of the

segments' (Luebke 1984). These dentinal injuries may be asymptomatic, or associated with symptoms and even orofacial pain (Cameron 1964, Homewood 1998, Ailor 2000).

Scarce information is available about the incidence of incompletely fractured teeth. In a clinical study of 1194 molars and premolars (Motsch 1992), incomplete fractures were found in about 3% of the teeth after removal of amalgam fillings. Furthermore, pain was rarely observed with this type of tooth injury, indicating that incompletely fractured teeth mainly exist without symptoms.

Incompletely fractured teeth may, in typical cases, be fairly simple to identify by common test procedures, such as selective bite-tests, use of staining solutions and transillumination. In other cases, however, they may be very difficult to localize because pain symptoms mimic other

*It is with regret we announce that Dr Tove Grevstad passed away during the summer of 2001.

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possible diagnoses like symptoms related to sinusitis, temporomandibular joint disorders, headaches, ear pain, or atypical orofacial pain (Snyder 1976). Traditional diagnostic tools may be less helpful in such cases, and have to be supplemented.

The purpose of this study was therefore to present findings from patients with diffusely localized orofacial pain, investigating the diagnostic value of different clinical findings, and analysing the distribution and pattern of pain experienced from incomplete dental fractures. Secondly, the effect of various treatment modalities were of interest.

Materials and methods

Thirty-two patients referred to the teaching clinic at the Faculty of Dentistry, University of Bergen with diffuse orofacial pain were finally diagnosed with 46 incompletely fractured teeth. Those included in the study represent a selected group of patients with one or more incompletely fractured teeth and associated diffuse orofacial pain.

The 32 patients were referred from general dental practitioners, oral surgeons, periodontists, general medical doctors and medical specialists. More than 50% of them had been suffering diffuse orofacial pain for more than 1 year, and had earlier consulted both dental and medical expertise. Yet, no specific diagnosis had been made.

They were now examined according to standardized questions, radiographic evaluation and clinical procedures, including percussion test, selective bite-test, use of staining solutions and transillumination. None of these patients, however, experienced the typical pain pattern normally associated with incompletely fractured teeth, i.e. pain of sudden onset and short duration provoked by cold and chewing pressure. The information was recorded in a form used at the dental clinic, specially designed for pain evaluation.

The patients were then subjected to a thorough examination in search of suspected incomplete fractures. The usual testing procedures, performed initially, did not directly aid in the detection of a possible incompletely fractured tooth. Radiographs were of little value in detecting an incompletely fractured tooth, but were taken in order to rule out other possible diagnoses. In cases with unilateral diffuse pain spreading to both maxilla and mandible, anaesthesia tests were of great help in determining the correct jaw. Thereafter, fillings were removed routinely, starting with the most posterior tooth, allowing direct inspection of possible fracture

lines. Removal of fillings was stopped when a fracture line was discovered. Removal of fillings located more mesially was continued if symptoms persisted after treatment. Methylene blue was, in many cases, used to stain a suspected crack. Microscopic evaluation and transillumination of the stained area provided even more information.

Once the fracture lines were revealed, further information was recorded; source of patient referral, affected jaw, affected tooth, extension of the fracture lines, type of restoration present, number of incompletely fractured teeth in each patient, duration of pain, and finally distribution and pattern of pain experienced by patients with one or more diagnosed incompletely fractured teeth in the same quadrant and by patients with affected teeth on both sides of the midline.

Results

Pathways of referrals to the endodontist

The referred patients had consulted their own general practitioner (GP) due to pain problems in the orofacial region, 26 patients more than twice. Nineteen patients (63%) were referred directly from the GP to the endodontist, four (9%) from oral surgeons, two from periodontists (6%) and seven (22%) from medical services. In the latter group, five patients had consulted an ear, nose and throat physician and two patients had consulted a neurologist. Three patients in this group were hospitalized. Still, the correct diagnosis was not made.

Incidence of crack lines

Analysis of the 46 teeth showed that the majority of the incompletely fractured teeth occurred in the maxilla, evenly distributed between premolars and molars, whereas molars predominated in the mandible (Fig. 1).

Twenty-three patients (72%) were diagnosed with only one incompletely fractured tooth. Nine patients (28%) exhibited incomplete fractures in more than one tooth, ranging from two to six. In four of these patients fracture lines were located in the same quadrant, and in five patients they occurred on both sides of the midline. No patients were recorded with fractured teeth in both jaws on one side only.

The majority (89%) of the incompletely fractured teeth occurred in heavily restored teeth (Fig. 2). Three infractions (7%) were found in teeth with class I restorations, and two (4%) in teeth without restorations.

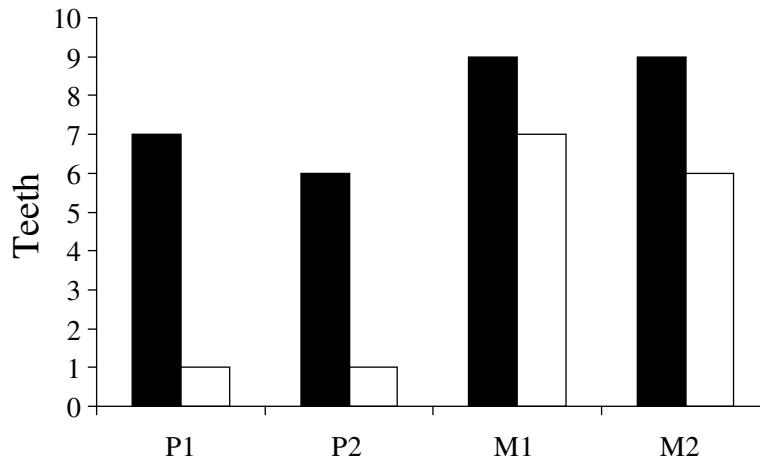


Figure 1 Distribution of infracted maxillary and mandibular teeth with symptoms. ■ = maxilla, □ = mandible. P1, first premolar; P2 second premolar; M1, first molar; M2, second molar.

Extension of fracture lines

All fracture lines extended in the mesio-distal direction, and in 10% of the cases they were running centrally in the tooth.

In maxillary teeth, 70% of the infractions were localized in the dentine supporting the buccal cusps, whilst 20% were on the lingual side. In the mandible, the situation was opposite, 20% buccally and 70% lingually.

Duration of pain prior to treatment

Twenty-five patients had been suffering pain for more than 3 months, one for as much as 11 years (Fig. 3). No connection was observed between duration of pain and the number of incompletely fractured teeth. Likewise, the duration of pain did not negatively effect the treatment outcome.

Distribution of pain

In cases with incompletely fractured mandibular teeth, the pain was felt throughout the arch and in tissues including neck, ear, chewing muscles and TMJ on the same side. In addition, it was regularly projected to maxillary teeth and tissues. In most cases the patient felt that the pain was located anterior to the affected tooth.

When one or more incompletely fractured teeth were diagnosed only in the maxilla, pain projecting to the mandible was reported infrequently. The pain was usually located anterior to the affected tooth. Location to the ear-region was infrequent.

The longer the duration of pain before the diagnosis of an incompletely fractured tooth was established, the



Figure 2 Symptomatic incomplete dentinal fracture under an amalgam filling. (a) An incomplete dentinal fracture (arrow) is seen after removal of an amalgam filling. (b) Access preparation reveals a fracture line involving the pulp chamber.

more diffuse was the distribution of pain. Often symptoms projected to both jaws.

In five patients, incomplete dentinal fractures occurred on both sides of the midline, in three of them in

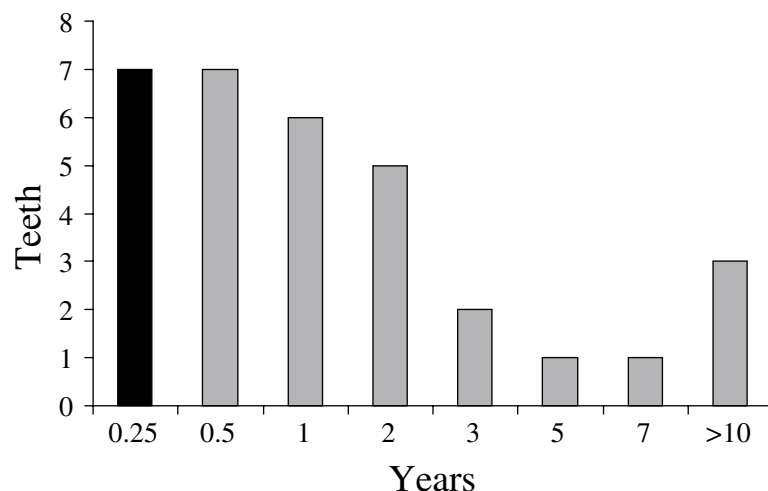


Figure 3 Duration of pain prior to treatment. ■ represents acute pain; ■ represents pain of chronic character.

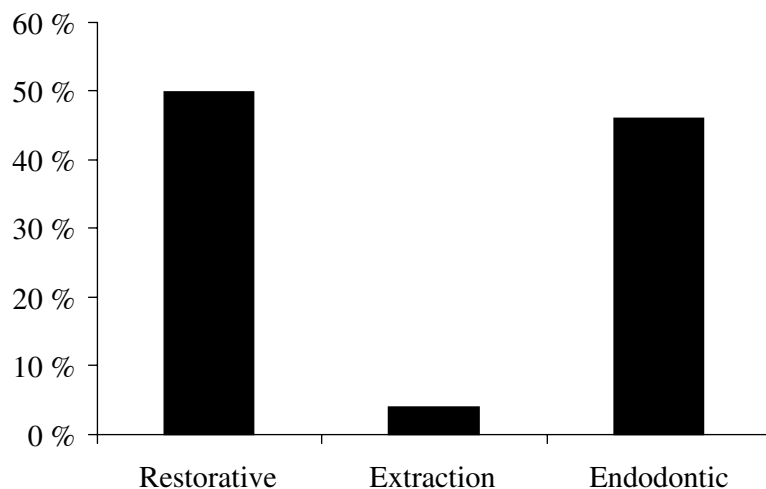


Figure 4 Types of treatment performed.

the maxilla. In these cases, pain was diffusely distributed throughout the mandibular and maxillary tissues including neck, ear, chewing muscles and TMJ on both sides. Headaches occurred in the group of patients with symptoms for more than 5 years prior to treatment.

Treatment

Endodontic or restorative treatment relieved the symptoms in 90% of the patients during a two-year follow-up, whilst persisting symptoms in 10% were considered as part of an orofacial pain complex of unknown aetiology. The patients who had been hospitalized were all made symptom free.

If symptoms persisted after temporary treatment, including reduction of occlusal load and stabilization of the fracture lines, a diagnosis of irreversible pulpitis was

made and root canal treatment was performed without delay. About half of the group was treated in this way, whilst the other half was treated with either cast restorations (cemented) or conventional fillings, always with cuspal coverage (Fig. 4).

Discussion

In our selected material, 28 out of 32 patients with incompletely fractured teeth and associated pain had suffered pain for more than 3 months, most of them for years. Despite numerous visits to different dental and medical specialists, the correct diagnosis was not made. This may indicate a lack of knowledge concerning this special problem, or it may be other contributing factors making the diagnosis difficult. The fact that some patients had multiple infracted teeth, ranging from

two to six infractions, makes the pain pattern in this group confusing and the diagnostics difficult. If incompletely fractured teeth were present on both sides of the midline, and the patient presented with a history of numerous visits to dentists and/or medical doctors, the patient most often arrived at our clinic with the diagnosis 'atypical pain', and the real cause remained undetected. We advocate that the dentist should suspect an incompletely fractured tooth in all cases with obscure aetiology and mixed chronic symptoms.

The pain pattern in patients with one diagnosed incompletely fractured tooth was not distinguishable from patients with more infractions in one quadrant.

Incompletely fractured teeth related to type of restoration

The majority of the infractions occurred in heavily restored teeth. Many studies (Mondelli *et al.* 1980, Abou-Rass 1983, Cavel *et al.* 1985), have shown how cavity design affects the strength of the tooth.

In teeth with extensive amalgam restorations, systematic removal of fillings proved to be the most efficient way of tracing incompletely fractured teeth in our material.

The most difficult diagnostic cases, were incomplete dentinal fractures in intact teeth and in teeth with class I restorations. Those patients had reported pain for a period of 2–10 years, and the pain was often projected to the ear region, radiating to both mandibular and maxillary regions. The affected teeth were, in these cases, premolars.

The best method for detecting infractions in intact teeth and in teeth with a small restoration, is transillumination by use of fibre-optics. The tooth should be properly cleaned before placing the light source directly against the tooth surface.

Treatment or observation?

Pain connected to incompletely fractured teeth is usually not acute, and does not require immediate treatment. The dentist should not feel compelled to treat all cases with symptoms. Misdiagnosis and mistreatment may easily follow. In this material we observed 'unnecessarily' root-filled and extracted teeth in search of the affected tooth, if there was any.

On the other hand, it is important to prevent the pain from becoming chronic. Sessle *et al.* (1986) described how neurones in the brain stem receiving input from skin, oral mucosa, neck muscles and TMJ become operative in longstanding pathophysiological situations, neurones which are normally ineffective in exiting the

nociceptive transmission neurones. Thus, both peripheral and central sensitization are involved to varying degrees in different types of hyperalgesia (Treede & Magerl 1995).

In our material, we found that in cases with longstanding pain, the perception of pain changed and the pain projected more diffusely throughout orofacial tissues, thus making the diagnosis more difficult. This indicates the importance of a thorough evaluation in the search for a diagnosis at an early stage in cases with orofacial pain. The specially designed form for pain evaluation used at our clinic was of great help in determining whether a dental cause of pain was present or not.

Treatment considerations

The treatment principles used in this study were in line with recommendations given by Homewood (1998). In about 50% of the cases, the diagnosis of irreversible pulpitis was determined, and endodontic treatment was performed. All of the incompletely fractured teeth with infraction lines running centrally in dentine were in this group.

Further studies may be necessary in order to determine whether teeth with centrally running infractions and a history of pain should be more readily root filled to avoid recurrence of pain. Later follow-up studies from this patient group support such a view.

In conclusion, this study shows that diagnosis of incompletely fractured teeth with symptoms is time consuming and represents a diagnostic problem. With appropriate endodontic and/or restorative treatment, symptoms were relieved in the majority of cases.

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